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The Land Improvement Tax Simulator (LITS)

An Analytical Tool

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ABSTRACT

Knowledge about effects of Federal income tax provisions on the use and treatment of land is important in analyzing and predicting changes in the use and management of land. This report describes an electronic spreadsheet model allowing comparisons of alternative tax treatment of expenditures for soil and water conservation, landclearing, and other land improvement investments. Each calculation is referenced to the Internal Revenue Code. A simple example application of the model is included along with listings of row headings, formulas, and required data input.

Keywords: Conservation, income taxes, land improvement, resource development, models, natural resources

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CONTENTS

	<u>Page</u>
Introduction	1
Advantages and Disadvantages of the LITS Model	1
Model Overview	2
Lotus Formulas	5
LITS Constants	5
Detailed Descriptions of LITS rows	6
Section 1: Land Purchase	6
Section 2: Improvements	6
Section 3: Financing Improvements	8
Section 4: Other Tax Items	8
Section 5: Tax Calculations	9
Section 6: Capital Gains	12
Section 7: Recapture	13
Section 8: Disposable Income	14
LITS Sample Description	15
References	17
Appendix Tables	18

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INTRODUCTION

Two major national policy issues reinforce interest in the income tax aspects of agricultural land conversion. First, income tax incentives have been blamed, at least in part, for conversion of marginal land to agricultural production during the cropland expansion of the late 1970's and early 1980's (3, 6, 7). 1/ Second, pressure for sweeping income tax reform has, in the agricultural area, focused on provisions subject to abuse by nonfarm interests sheltering nonfarm income (2). Current policy research seeks to understand the role income taxes play in facilitating land conversion and to estimate the effect of changes in tax law on financial incentives to develop cropland.

For such analysis, ERS researchers developed an electronic spreadsheet model of the financial and tax aspects of cropland development and soil conservation. This paper documents the Land Improvement Tax Simulator (LITS), detailing the formulas used in the model, providing references to the Internal Revenue Code and other interpretative material for each calculation, and providing guidance to model users.

ADVANTAGES AND DISADVANTAGES OF THE LITS MODEL

The LITS model allows comparison of alternative tax treatment of expenditures for soil and water conservation, landclearing, and other land improvement investments. Comparisons can be based on realistic, full-value amounts of investments, income, and expenses for up to 20 years. Effects of a change in interest rate and/or a change in financed amount (leverage) can be readily modeled. Provisions were made for easily adjusting holding and finance periods, interest rate, and capitalization to affect tax treatment of land improvement investments.

In contrast, the LITS model also suffers from many shortcomings of other tax models. Much data needed for analysis of farm and aggregate agricultural tax situations are not available. These include such parameters as the planning horizon of farmland owners, individuals' discount rates, and firm-level information on farm and nonfarm income and expenses. Data on capital gains realized from agricultural land are also unavailable either on an individual or an aggregate basis. Nevertheless, the LITS model can be used to estimate the affects of alternative tax regulations on farm-level situations using synthetic and/or average farmer-taxpayer parameters.

1/ Underscored numerals in parentheses refer to items in References.

MODEL OVERVIEW

LITS is a table or matrix with investment and tax calculations pertaining to land improvements listed as rows and the years in which they occur shown as columns (table 1). Cell entries are, with some exceptions, current dollar amounts of the investment or tax items listed in the row headings. Two summary columns contain the discounted net present value and simple sum of each relevant row over the analysis period. The spreadsheet is constructed for analysis periods of up to 20 years, calculated from the year improvements are first made to the point when the improved land is sold.

LITS rows fall into eight sections. Sections 1 and 2 allow the analyst to specify the amount and timing of land purchase and land improvements. Improvements are further grouped into nondepreciable soil and water conservation improvements, nondepreciable landclearing improvements, and depreciable improvements. Section 3 details the financing of long-term improvements, using a user-specified interest rate recorded in a separate cell. Farm and nonfarm income streams and nonfarm adjustments to income are specified by the user in section 4. Income tax calculations for an individual married taxpayer filing a joint return are detailed in section 5, including all relevant lines of Schedule F and Form 1040. Calculations related to capital gains treatment of the land and improvements are made in section 6. Provisions for recapture of deductions for land improvements, investment tax credit, and depreciation allowances are included in section 7. Section 8 calculates a direct measure of the financial well-being of the investor over the investment period, abstracting from income measures used in calculating taxes. This "bottom line" of the model is termed "Disposable income" and is useful in comparing results of alternative investments or tax treatments.

The first column of LITS is labeled "Year 0" and provides a place to record some details of the situation immediately before the land improvement investment is undertaken. This column is not included in summary calculations of discounted net present values or sums over the analysis period. Detail in the columns labeled "Year 1" through "Year 20" relate to the timing of improvement investments and the flow of income and expenses related to the farm operation. Effects of inflation and deflation can be accommodated explicitly in these columns by increasing or decreasing income and expense items in subsequent years. Because of the way discounting and financial calculations are carried out in Lotus 1-2-3, all investments and expenditures are treated as though they occur on the first day of the year. This causes some minor inaccuracy on items like depreciation, where the appropriate first year depreciation constant depends on the month of investment, but is generally acceptable for analytic purposes.

The columns labeled "Net present value" and "Sum of years" summarize results of the improvement investment over the analysis period, which can vary from 2 to 20 years in length. The "Net present value" column contains the discounted present value of the stream of results occurring in years 1 through 20, thus reducing all cash flows to current dollar terms at the beginning of year 1. The discount rate is a user-specified constant recorded in a separate cell. The discount rate can be identical to the interest rate used in financing calculations (see section 3) or it can differ from the interest rate. The "Sum of years" column contains the simple sum of all cash flows recorded in years 1 through 20 for each row. Because this measure does not reflect the time value of money inherent in the timing of cash flows, it is generally less informative than the "Net present value" column.

Table 1--Sample output from the Land Improvement Tax Simulator

Land Improvement Tax Simulation (LITS) Version 2 6/10/86 for individual returns - 1984 tax regulations						
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Section 1: Land purchase						
Purchase amount	256,000	0	0	0	0	0
Amount financed	200,000	0	0	0	0	0
						Net present value
						Sum of years
Section 2: Improvements						
Nondepreciable: soil and water						
Leveling and grading		2,000	0	0	0	0
Soil conditioning		1,500	0	0	0	0
Terracing		8,000	0	0	0	0
Restoration of fertility		0	0	0	0	0
Diversior channels		4,000	0	0	0	0
Drainage ditches		0	0	0	0	0
Irrigation ditches		0	0	0	0	0
Earthen dams		0	0	0	0	0
Watercourses and outlets		2,000	0	0	0	0
Ponds		0	0	0	0	0
Eradication of brush		0	0	0	0	0
Windbreaks		0	0	0	0	0
SCWD assessments		0	0	0	0	0
Total		17,500	0	0	0	0
Nondepreciable: landclearing						
Removal of trees and rocks		3,000	0	0	0	0
Earthmoving		0	0	0	0	0
Drainage and filling		2,000	0	0	0	0
Total		5,000	0	0	0	0
Depreciable:						
Drainage tile (Sec. 1245) 1/		1,000	0	0	0	0
Machinery and equipment (Sec. 1245)		0	0	0	0	0
Single-purpose buildings (Sec. 1245)		4,500	0	0	0	0
Depreciable amount		475	0	0	0	0
Multipurpose buildings (Sec. 1250)		0	0	0	0	0
Depreciable amount		0	0	0	0	0
Total		475	0	0	0	0
						16
						198,280
						208,194
						9,914
						228,000
						46,374
						281,376
						53,376
Section 3: Financing improvements						
Finance period		20	19	18	17	16
Long-term balance	200,000	228,000	221,105	213,865	206,263	198,280
Long-term payment		18,295	18,295	18,295	18,295	208,194
Interest payments		11,400	11,055	10,693	10,313	9,914
Section 4: Other tax items						
Farm business receipts		175,000	175,000	175,000	175,000	165,000
Farm business expenses		139,000	139,000	139,000	139,000	139,000
Nonfarm income		12,000	12,000	12,000	12,000	12,000
Adustments to income		3,500	3,500	3,500	3,500	3,500
Itemized deductions & exemptions		5,000	5,000	5,000	5,000	5,000
						749,823
						601,797
						51,954
						15,153
						21,647
						865,000
						695,000
						60,000
						17,500
						25,000
Section 5: Tax calculations						
Gross farm income (Sch. F 1.31)		175,000	175,000	175,000	175,000	165,000
Consv. expense (Sch. F 1.49)		17,500	0	0	0	0
						749,823
						16,667
						865,000
						17,500

Table 1--Sample output from the Land Improvement Tax Simulator--Continued

Land Improvement Tax Simulation (LITS) Version 2 6/10/86 for individual returns - 1984 tax regulations							Net present value	Sum of years
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5		
Landclearing exp (Sch. F 1.50)		507	0	0	0	0	483	507
5-year ACRS depreciation 2/		71	105	100	100	100	409	475
18-year ACRS SL depreciation 3/		0	0	0	0	0	0	0
Depreciation (Sch. F 1.53)		71	105	100	100	100	409	475
Deductions except Sch. F 1.50		172,971	150,160	149,793	149,413	149,014	670,009	771,351
Total deduction (Sch. F 1.55)		173,478	150,160	149,793	149,413	149,014	670,492	771,858
Net farm income (Sch. F 1.56)		1,522	24,840	25,207	25,587	15,986	79,331	93,142
Investment credit (F. 3468 1.22)		48	0	0	0	0	45	48
Farm income (F. 1040 1.19)		1,522	24,840	25,207	25,587	15,986	79,331	93,142
Total income (F. 1040 1.23)		13,522	36,840	37,207	37,587	77,882	170,380	203,038
Adjusted gross (F. 1040 1.32)		10,022	33,340	33,707	34,087	74,382	155,227	185,538
Taxable income (F. 1040 2.37)		5,022	28,340	28,707	29,087	69,382	133,579	160,538
Tax (F. 1040 2.40)		178	4,400	4,492	4,587	19,109	26,787	32,766
Business credit (F. 1040 2.48)		48	0	0	0	0	45	48
Alt. minimum tax (F. 1040 2.52)		0	0	0	0	4	3	4
Taxes owed (F. 1040 2.56)		131	4,400	4,492	4,587	19,112	26,744	32,722
Section 6: Capital gains (long-term)								
Undeducted S&WC investments	256,000	260,897	260,792	260,692	260,593	260,498	0	0
Basis of new land		0	0	0	0	0	284,000	362,464
Sale		0	0	0	0	0	79,893	101,966
Long-term capital gain		0	0	0	0	0	0	0
Long-term capital loss	0	0	0	0	0	0	0	0
Loss carryover	0	0	0	0	0	0	0	0
Income less capital gain		0	0	0	0	28,596	22,406	28,596
Tax on income-capital gain		0	0	0	0	4,464	3,498	4,464
Tax on capital gain		0	0	0	0	14,648	11,477	14,648
Section 7: Recapture								
S&WC and landclearing (F. 4797 1.23(c))		18,007	0	0	0	0	17,150	18,007
Subject deductions	4	5	6	7	8	9		
Years held		1.0	0.8	0.6	0.4	0.2		
Recapturable portion		0	0	0	0	3,601	2,822	3,601
Recapture amount (F. 1040 1.15)		48	38	29	19	10	127	143
Investment credit (F. 4255)		0	0	0	0	10	7	10
Recapturable amount		0	0	0	0			
Recapture amount (F. 1040 1.53)		0	0	0	0			
ACRS depreciation (F. 4797 1.21(b))		0	0	0	0	5,499	4,308	5,499
Recapture amount		0	0	0	0	9,110	7,138	9,110
Total recapture								
Section 8: Disposable income								
		29,574	25,305	25,213	25,118	117,157	185,358	222,366

1/ Numbers in parentheses refer to Internal Revenue Code sections (Sec.) and Internal Revenue Service schedules (Sch.), forms (F.), and page-line numbers.

2/ ACRS refers to the Accelerated Cost Recovery System in the Internal Revenue Code.

3/ SL refers to the straight-line form of depreciation.

Analysis periods of less than 20 years are accommodated in LITS since the "Net present value" and "Sum of years" calculations simply include zeros for years beyond the desired period. The user must be careful to exclude nonzero values in user-specified cells for years subsequent to the end of analysis periods shorter than 20 years.

LOTUS FORMULAS

The LOTUS 1-2-3 (Version 2.0) program contains provisions for a number of operators, constants, and functions which permit the use of quite complicated formulas within a given spreadsheet row, column, or single cell (5). In addition to the usual arithmetic operators (+ addition, - subtraction, * multiplication, / division), a number of other logical operators may be used. The principal logical operator used in the LITS spreadsheet was ">" interpreted as "greater than."

The use of a "\$" in a cell address fixes that address as an absolute rather than a relative location within either a row, a column, or a single cell. For example, \$AA\$25 specifies the value in the cell at column AA, row 25 regardless of how it is used in the formulas. The range "\$Z\$8..\$AB\$22" specifies those cells from column Z through column AB and from row 8 through row 22, regardless of where the range is used in the spreadsheet.

LOTUS functions always begin with the @ symbol and are of the general form:

@functionname(argument1,argument2,...,argumentN)

The allowable arguments for a single value can be a number, a cell address, another function, a one-cell range name, or a formula. If the function requires a range, it can be specified as "cell address..cell address" or as a "range name." For functions to work, they must have the correct number of arguments in the correct order and of the correct type, either a single value or a range.

The functions used in the LITS spreadsheet include:

@IF(cond,x,y)	The value x if cond is TRUE, the value y if cond is FALSE.
@SUM(list)	Sums the values of all items in list.
@MIN(list)	Selects minimum of all values in list.
@MAX(list)	Selects maximum of all values in list.
@PMT(princ.,int.,term)	Computes payment on loan with given principal, interest rate, and term.
@CHOOSE(x,v1,v2,...vN)	Selects argument value.
@VLOOKUP(x,range,offset)	Vertical table lookup.
@NPV(int.,range)	Computes net present value for the series of cash flows specified in the range at the specified interest rate.

LITS CONSTANTS

Several ranges in the spreadsheet model are constants referring to specific legal or temporal situations. They can be modified by the user, but care should be used to insure that consistent and rational analyses result. Cell

\$AA\$25 in the LITS worksheet contains the interest rate used to calculate debt repayment and to discount income streams to present value. This cell can be specified by the user. Range \$Z8 to \$AB22 contains the tax table used in calculating income taxes (see table 2). This range should not be modified by the user, except for hypothetical analyses, since the tax structure modeled in LITS and this tax table both correspond to the 1984 tax year.

DETAILED DESCRIPTION OF LITS ROWS

A detailed description of each row of the LITS spreadsheet is provided in this part of the report. Assumptions and shortcomings of the method are presented. Formulas and references to relevant sections of tax law and interpretation are provided.

Section 1: Land Purchase

The first row in this section (row 5) allows the user to record the purchase amount of land bought for agricultural development. If recorded in year 0, the land is considered to be already owned and is not dealt with as part of the investment. Land purchase generally occurs in year 1 of the investment. Land purchase cannot be recorded in years subsequent to year 1 because the financing and present value calculations are not designed to reflect this possibility. Multiple transactions occurring over several years should be analyzed as separate investments, then aggregated.

The second row in this section (row 6) allows the user to record the amount of the land purchase price subject to long-term financing (see Section 3). Any portion from zero to 100 percent of the purchase amount can be financed.

Row 6 highlights one of the differences between financial and economic analysis of investment decisions. A financial accounting is concerned with recording only the actual cost of capital to purchase land for improvement, and should reflect terms on which such financing can be obtained in reality. This is also the basis on which interest payments are deductible for income tax purposes. On the other hand, an economic accounting would reflect the opportunity cost of capital obtained, including alternative returns the investor might be able to get on equity invested in the land. From an economic perspective, the opportunity cost of capital on both the equity and debt portions of the investment might be higher or lower than the nominal interest required by banks. However, the economic measure of capital cost is not reflected in tax deductions for interest payments. LITS is flexible enough to accommodate either approach, but an economic evaluation of capital cost will introduce some distortions in tax calculations.

Section 2: Improvements

Land improvement investments are divided into three groups according to their tax treatment: nondepreciable soil and water conservation improvements, nondepreciable landclearing improvements, and depreciable improvements. Nondepreciable soil and water conservation improvements on land used in farming are deductible from gross farm income under Internal Revenue Code (IRC) Section 175, rather than capitalized into the basis of the property. Rows 10-22 list categories of improvements considered nondepreciable soil and water conservation investments (4, p. 18; 1, para. 1059). Nondepreciable landclearing expenses to make land suitable for farming may be deducted from

gross farm income under IRC Section 182, rather than capitalized. Rows 25-27 record categories of eligible landclearing expenses (4, p. 19; 1, para. 1060). Rows 23 and 28 calculate the sums for each year of rows 10-22 and 25-27, respectively.

Government payments to share costs of conservation improvements are not explicitly considered in LITS. If the taxpayer elects to report cost-share payments as income, gross farm income should be increased and both the farmer and government share of the cost of the improvement are eligible for the deduction. If cost-share payments are not reported as income, only the farmer's share of improvement costs should be reported in section 2. Examination of eligible soil and water and landclearing expenses shows that many kinds of land improvements could qualify under either provision. Treatment as soil and water conservation expenses is generally less restrictive than as landclearing expenses (see section 5). Unless the land was not used for farming in any way prior to development, by the current owner or previous owner, improvements can be deducted as soil and water conservation expenses. Some categories of land improvement investments will clearly result in higher tax liabilities than others.

Depreciable land improvements include manufactured or constructed improvements for which depreciation allowances may be claimed (1, paras. 1059,1060). Rows 30-32 record investments in drainage tile, machinery and equipment, and single-purpose buildings necessary for the land improvement which are IRC Section 1245 5-year recovery property under the Accelerated Cost Recovery System (ACRS) of IRC Section 168. Row 34 records investments in multipurpose (IRC Section 1250) buildings which are real 18-year recovery property depreciated under optional straightline election.

Rows 33 and 35 sum the 5- and 18-year depreciable amounts, but the formulas are complicated by two additional provisions. First, the taxpayer can elect to immediately deduct up to \$5,000 of qualifying recovery property as an expense rather than a capital expenditure (IRC Section 179; 1, para. 1165P). All Section 1245 property qualifies for this election and, since it is generally advantageous to deduct rather than to capitalize, we have assumed that the taxpayer will elect to deduct the first \$5,000 of investments summed in row 33. This deduction option is not always favorable, but since a complete optimization over the planning period would be required to determine the choice between deducting and capitalizing, no option was provided in the spreadsheet. No investment tax credit is allowed for investments expensed under IRC Section 179. Second, the depreciable basis of recovery property qualifying for investment tax credit must be reduced by 50 percent of the tax credit. In other words, the depreciable amount is 95 percent (100% - 50%*(10% credit)) of the original basis. Application of these two provisions results in the following formula for row 33:

row 33 = 0.95*@MAX(0,n30+n31+n32-5000)
where n = the current year (column).

The effect is to deduct \$5,000 from the sum of rows 30-32 and take 95 percent of remaining investments as the depreciable amounts. Row 36 is the sum of rows 33 and 35.

Preproductive expenses are not explicitly treated in LITS, although they can be reflected in the model. Improvements undertaken before land reaches a productive state can be preparatory or development expenses (1, para. 1061).

Development expenses are permanent land improvements such as those listed in section 2 and cannot be deducted in the preproductive stage: they must be capitalized. Preparatory expenses like cultivation, irrigation, and fertilization which could ordinarily be deducted as expenses once the land is producing can be deducted in the preproductive stage, but they can be capitalized. If no farm receipts are entered in row 45, the costs of these preparatory activities can be entered in row 46 (deducted), or in section 2 (capitalized).

Section 3: Financing Improvements

Financed amounts of land purchase and improvement investments are summed in section 3, payments and interest are computed, and the balance recomputed for the next period.

Row 39 records the term over which the balance in row 40 will be financed. Financing of all improvements is assumed to terminate in the year of sale, or by year 20, whichever comes first. The remaining finance period in row 39 is reduced by 1 year for the next period.

The long-term balance in row 40 is the sum of the balance from the previous period, plus the sum of land purchases financed (row 6) and improvements (rows 23, 28, 30, 31, 32 and 34). If a sale occurs (row 74 > 0), the last payment in row 41 includes the remaining balance plus interest for the last year. If no sale occurs, the payment in row 41 is calculated on the balance in row 40 for the remaining period in row 39. The resulting formula is as follows:

row 41 = @IF(n74>0,n40*(1+\$AA\$25),@PMT(n40,\$AA\$25,n39))
where n = the current year.

The interest payment in row 42 is simply the user-specified interest rate times the balance in row 40.

Section 4: Other Tax Items

Section 4 supplies information about income and expenses, adjustments to income, and itemized deductions and exemptions needed to calculate taxes. The amount of farm business receipts, for both the existing farm and newly improved land, must be entered by the user in row 45 for each year in the analysis period. Any changes in receipts, because of yield increases during the process of conversion or due to inflation, must be entered explicitly, or through a formula, by the user. Similarly, ordinary farm business expenses not specifically accounted for in conversion costs and financing must be entered by the user in row 46.

Nonfarm income for each year, from enterprises or wages outside the farm operation, must be entered explicitly in row 47 by the user. In addition, adjustments to income corresponding to items reported in lines 24 to 31 of IRS Form 1040 must be explicitly entered in row 48. Nothing of substance to the analysis is normally contained in this row, so a constant amount, perhaps adjusted for inflation, is entered for each year. Typical itemized deductions commensurate with the gross income of the situation being modeled (as on IRS Schedule A) and a \$1,000-exemption for each dependent must be entered in row 49. Information from rows in this section is used in the tax calculations in section 5.

Section 5: Tax Calculations

Items in this section correspond directly to lines on IRS Schedule F, Form 1040, and Form 3468. Calculations draw on data entered in sections 2, 3, and 4 outlined above.

Gross farm income is simply the farm business receipts entered in row 45, section 4. Soil and water conservation expenses can be deducted immediately instead of capitalized into the basis of the property (IRC Section 175; 1, para. 1059; 4, p. 18). However, conservation expensing is limited to 25 percent of gross farm income, but may be carried over indefinitely to subsequent years. The formula for calculating soil and water conservation deductions in any year thus sums all improvements listed in row 23 for the current and previous years, less all deductions in row 53 for previous years, and takes the lesser of this difference and 25 percent of gross farm income in row 52. In Lotus 1-2-3, the formula is:

row 53 = @MIN(@SUM(\$C23..m23)-@SUM(\$C53..m53)+n23,0.25*n52)
where n = the current year;
m = the previous year.

Landclearing expenditures can also be immediately deducted instead of capitalized into the property's basis (IRC Section 182; 1, para. 1060; 4, p. 19). Provisions for deduction of landclearing expenses are more restrictive than for soil and water conservation expenses. Deductions are limited to the lesser of the actual expense, \$5,000 or 25 percent of net farm income, and there is no carryover of deductions. The formula is:

row 54 = @MIN(n28,@MAX(0,@MIN(0.25*(n52-n58),5000)))
where n = the current year.

Since many improvements can be reported as either soil and water conservation expenses or landclearing expenses, the careful taxpayer would categorize such investments so as to minimize the present value of tax liabilities. This generally means reporting a maximum of \$5,000 as landclearing expenses, subject to net farm income limits, and reporting the remainder of qualified improvement investments as soil and water conservation expenses.

Accelerated cost recovery system (ACRS) depreciation of 5-year property for the current year is calculated in row 55 based on the depreciable amount recorded in row 33. ACRS percentages for 5-year property are 15 percent in the first year, 22 percent in the second year, and 21 percent in each of the 3 remaining years (IRC Section 168; 1, para. 1165A; 4, p. 23). In any year, the depreciation calculated is the sum of the appropriate percentage times the depreciable amount from row 33 from each prior year up to 5 years previous. The formula is thus :

row 55 = 0.21*j33+0.21*k33+0.21*l33+0.22*m33+0.15*n33
where n = the current year;
m = the previous year;
l = 2 years previous, and so on back to 5 previous years.

Calculation of ACRS depreciation on multipurpose buildings is simplified because of the option to elect 18-year, straightline (SL) depreciation, which is assumed in LITS. Depreciation is calculated by summing depreciable amounts

of all qualified investments since the beginning of the analysis and dividing by 18. The formula is as follows:

row 56 = @SUM(\$C35..n35)/18
where n = the current year.

Row 57 is the sum of the 5- and 18-year depreciation from rows 55 and 56.

The calculation in row 58 sums deductions from farm income except for the landclearing expense deduction in line 50, Schedule F. This figure is used in calculating net farm income in the absence of landclearing in order to limit the allowable landclearing expense. It includes farm business expenses (row 46), conservation expenses (row 53), depreciation (row 57), interest payments (row 42), and the maximum allowable one-time expensing of depreciable investments (IRC Section 179; see section 2). Actual total deduction from farm income is calculated in row 59 as the sum of row 57 and the landclearing deduction in row 54. Net farm income is the difference between gross farm income (row 52) and total deductions (row 59), recorded in row 60.

Regular business investment credit for farm-related investments analyzed in the LITS model is computed on IRS Form 3468 (IRC Section 46; 1, paras. 1178-1183; 4, pp. 27-28). The investment tax credit (ITC) is 10 percent of the depreciable amount of qualified investments recorded in rows 33 and is recorded in row 61 of the spreadsheet. For Section 38 recovery property, the taxpayer must choose between reducing the basis of the property by half of the ITC, or taking only an 8-percent ITC (IRC Section 48; 1, para. 1180a-b). Calculations in the LITS model assume election to reduce the depreciable basis and take the full 10-percent ITC. The user is cautioned that this election is not always optimal, but a complete optimization over the entire planning period is impractical in the spreadsheet format.

Moving to IRS Form 1040, the individual's tax return, net farm income from Schedule F is transferred to row 62. Total income in the model (row 63) consists of nonfarm income (row 47), farm income (row 62), 40 percent of long-term capital gains from sale of the property, less allowable long-term capital losses, plus any recaptures of credit items (row 93). Long-term capital losses are limited to half the sum of current (row 76) and carried-forward (row 77) losses, \$3,000, or income, whichever is least (IRC Section 1211; 1, para. 971). Recapture can be from landclearing or conservation expense deductions, investment tax credit, or ACRS depreciation (see section 7). The formula for computing total income is as follows:

row 63 = n47+n62+0.4*n75-@MIN(0.5*(n76+n77),@MIN(3000,@MAX
(n47+n62+n93-3400,0)))+n93
where n = the current year.

Adjusted gross income is total income less adjustments to income recorded in row 48 for things like moving expenses, Individual Retirement Account deductions, alimony, and the marriage deduction. Subtracting itemized deductions and exemptions (row 49) from row 64 gives taxable income (row 65), from which the actual taxes are calculated in each year of the period.

Income taxes in LITS are based on tax schedule Y for married individuals filing joint returns (table 2). The tax calculation is accomplished in Lotus 1-2-3 with "lookups" for the three columns of the tax table stored in range Z8..AB22 of the spreadsheet.

Table 2--Tax table (Schedule Y) for married individuals with joint returns,
1984 tax year

Taxable income		Pay this	Plus this	Of taxable
Between	And	amount	percent	income over--
<u>Dollars</u>		<u>Dollars</u>	<u>Percent</u>	<u>Dollars</u>
0	3,400	0	0	0
3,400	5,500	0	11	3,400
5,500	7,600	231	12	5,500
7,600	11,900	483	14	7,600
11,900	16,000	1,085	16	11,900
16,000	20,200	1,741	18	16,000
20,200	24,600	2,497	22	20,200
24,600	29,900	3,465	25	24,600
29,900	35,200	4,790	28	29,900
35,200	45,800	6,274	33	35,200
45,800	60,000	9,772	38	45,800
60,000	85,600	15,168	42	60,000
85,600	109,400	25,920	45	85,600
109,400	162,400	36,630	49	109,400
162,400	higher	62,600	50	162,400

Source: 1985 Master Tax Guide, p. 11.

The formula for total taxes is:

row 66 = (n65-@VLOOKUP(n65,\$Z8..\$AB22,0))*@VLOOKUP(n65,\$z8..\$ab22,2)
+ @VLOOKUP(n65,\$Z8..\$AB22,1)

where n = the current year.

Business credit is the ITC calculated in row 61 and is subtracted from total taxes in row 66 in computing taxes owed in row 69. Also involved in computing the total taxes owed by a taxpayer is the alternative minimum tax (AMT). The most likely circumstance that would involve the AMT in normal farm situations is when a major sale of assets occurs producing a large capital gain. In the LITS model, this is the only time the AMT is computed. The formula is:

row 68 = @IF (n75>0,@MAX(0.2*(n64+0.6*n75-40000)-n66+n67,0),0)

where n = the current year.

That is, if there is a capital gain, the AMT is computed as 20 percent of adjusted gross income, plus the portion of capital gain excluded in computing adjusted gross income, minus a \$40,000-exclusion (for a married couple filing a joint return), minus the net of taxes due before considering the alternative minimum tax and any business credit available. The value of the AMT cannot be negative, or reduce ordinary income tax.

The formulation used in the LITS model ignores other possible tax preference items and possible AMT itemized deductions. The general assumption is that these would be offsetting. Taxes owed (row 69), then, are the sum of income

tax due from row 66 minus the business credit from row 67 plus the alternative minimum tax from row 68. This is the tax liability for each year in the analysis period.

Section 6: Capital Gains

Only long-term capital gains resulting from purchase, improvement, and disposition of land are modeled in LITS. This section accounts for changes in the basis of the property, records the sale, computes gain or loss from sale, and computes the income tax attributable to capital gains. Tax computations in this section do not substitute for tax computations in Section 5, but merely add more detailed information to help analyze the impact of capital gains on tax liability.

Qualified soil and water conservation expense deductions carried forward at the time the land is sold may not be used to reduce the basis prior to computing capital gains (4, p. 19). Unused conservation deductions can be used by the seller if he or she returns to farming at a later date. The excess of conservation expenses over conservation deductions at the time of sale is calculated in row 72 for purposes of analysis, but is not used in capital gains computations.

The basis of the property is kept current in each year of the analysis period through computations in row 73. To the previous year's basis is added any land purchases (row 5), landclearing expenses (row 28), and depreciable improvements (row 36). Landclearing expense deductions (row 54) and depreciation (row 57), and half of any recaptures of investment tax credit (row 90) are subtracted from the basis, but the result can never fall below zero. The resulting formula is:

row 73 = @IF(+m73+n5+n28+n36-n54-n57-0.5*n90<0,0,+m73+n5+n28+n36-n54-n57-0.5*n90)

where n = the current year;
m = the previous year.

Only one sale of the property can be entered in row 74, which ends the improvement investment. A sale is not required, but the effect of capital gains treatment and recapture cannot be analyzed until the improved property is sold. So, a sale is required to get an accurate estimate of all tax benefits for land improvements.

Long-term capital gain or loss is computed in rows 75 and 76, respectively. The difference between the sale price in row 74 and the current basis in row 73 is checked for a gain (positive), a loss (negative), or if no gain or loss occurs (zero). The formulas are as follows:

row 75 = @IF(n74-n73>0,n74-n73,0)
row 76 = @IF(n74=0,0,@IF(n74-n73<0,n73-n74,0))
where n = the current year.

Long-term capital losses can be carried over indefinitely to subsequent years (IRC Section 1211; 1, para. 972). Carryover is computed as the difference between the sum of the previous period's carryover and losses and the amount of

loss which was deducted from income in the previous period (see computations for row 63). The formula is:

row 77 = +m76+m77-@MIN(0.5*(m76+m77),@MIN(3000,@MAX(m47-m49+m62+m93-3400,0)))
where m = the previous year.

Income less capital gain in row 78 is used to calculate what taxes would have been without the capital gain in row 79. If capital gain is positive, it is simply taxable income (row 65), less 40 percent of the gain; otherwise it is zero.

The formula is:

row 78 = @IF(n75>0,(n65-0.4*n75),0)
where n = the current year.

Tax on income less capital gain (row 79) is calculated just as in row 66, but substituting the income in row 78 for taxable income in row 65. Tax on the capital gain (row 80) is the difference between the tax computed in row 66 plus row 68 with capital gains and that computed in row 79 excluding the gains plus any alternative minimum tax. If there is no capital gain in the current analysis period, the formula enters a zero in both rows.

Section 7: Recapture

Most tax provisions relevant to investments in land improvements are subject to recapture if the property is sold before it has been held for specified periods. That is, all or part of an amount previously deducted must be added to ordinary income in the year of the sale. While recapture is governed by distinct portions of the Internal Revenue Code, recapture of deductions related to land improvements is generally tied to the length of time the land was owned, not the time since the improvement was made. The exception is recapture of ITC, which is predicated on the time the depreciable asset itself is held.

Soil and water conservation and landclearing expense deductions are recaptured on a proportional basis if the property on which improvements were made is held less than 10 years and a gain accrues from the sale (IRC Section 1252; 1, para. 998e; 4, p. 41). Row 84 accounts for conservation and landclearing expense deductions subject to recapture in each year of the analysis period. It is simply the sum of rows 53 and 54. Row 85 accounts for the number of years since the land was acquired, adding a year to the initial number entered by the user in year 0 for each year that passes. The recapturable portion of subject deductions is calculated in row 86 if the number of years held in row 85 is less than 10. The recapture percentage is 100 percent if the property is held 5 years or less, declining to 80 percent in the sixth year, 60 percent in the seventh year, 40 percent in the eighth year, and 20 percent in the ninth year held. The recapture amount is calculated only if there is a sale, and the recapture percentage from row 86 is applied to the sum of recapturable amounts in row 84. If capital gains from the sale are not positive, the recapturable amount is zero. The formulas are:

row 86 = @IF(n85<10,@CHOOSE(n85,1,1,1,1,1,1,0.8,0.6,0.4,0.2),0)
row 87 = @IF(n74>0,@MIN(n86*@SUM(\$C84..n84),@MAX(n75,0)),0)
where n = the current year.

When IRC Section 38 property on which an ITC was taken is sold before the end of the recapture period, a portion of the credit taken is added to ordinary income (IRC Section 47(a)(5); 1, para. 1184; 4, pp. 33-34). The recapture percentage is 100 percent in the first year the asset is held, declining by 20 percent for each year until the sixth year. Row 89 continuously accounts for recapturable amounts of investment credit for qualified investments made in each year, adding 100 percent of current year investments, and dropping 20 percent of each previous year's investments with each new year. The recapture amount in row 90 is the recapturable amount in row 89 if a sale occurs, and is zero otherwise. The formulas are:

row 89 = +0.2*j61+0.4*k61+0.6*161+0.8*m61+n61
row 90 = @IF(n74>0,n89,0)
where n = the current year;
m = the period 1 year previous;
l = the period 2 years previous, and so on.

Gains from sale of depreciable property must be recaptured as ordinary income to the extent of the amounts depreciated in previous years (IRC Section 1245; 1, para. 987a-988; 4, p. 40). For this purpose, depreciation includes ACRS depreciation on Section 1245 recovery property, any deduction claimed under the election option of Section 179 (see explanation for row 33), and the basis reduction equal to half the investment tax credit elected to receive the full 10-percent ITC. Depreciation on Section 1250 property is recapturable only to the extent that it exceeds what would be depreciated using a SL method. Since an 18-year, SL depreciation method is assumed for multipurpose buildings in row 56, no recapture is required. The formula is as follows:

row 92 = @MIN(@SUM(\$C55..n55)+0.05*(@SUM(\$c33..n33)+(\$x30+\$x31+\$x32-\$x33/.95),@max(n75,0))
where n = the current year.

The sum of rows 87, 90, and 92 gives the total amount of past tax deductions recaptured as ordinary income, and is included in total income computed in row 63.

Section 8: Disposable Income

The "bottom line" of LITS, both literally and figuratively, is a measure of the taxpayer's well-being abstracted from the strict accounting framework used in calculating his or her taxes. In the context of LITS, disposable income in each nonsale year is defined as nonfarm income (row 47), plus farm business receipts (row 45), less farm business expenses (row 46), less taxes owed (row 69), less payments on long-term debt incurred because of the improvements (row 41). In the year of sale, disposable income increases by the sale price (row 74), less the purchase amount of the land (row 5), plus the amount of the purchase price financed (row 6). This measure reflects the taxpayer's actual cash incomes and outlays, including those for taxes, as they occur during the investment. The formula for disposable income is:

row 95 = @IF(n74>0, n47+n45-n46+n74-n69-n41-\$B5+\$B6, n47+n45-n46-n69-n41)
where n = the current year.

LITS SAMPLE DESCRIPTION

The sample output of the LITS model presented in table 1 provides considerable insight into the workings and the possibilities of the tax simulation model. The workings of the model are further explained here with the numerical data in the sample output.

The numerical data in section 1, year 0, present an assumed purchase amount and the amount of the purchase financed for the farm situation being analyzed. Section 2, year 1, presents a variety of improvements assumed to have been made as indicated by the amounts shown for the individual improvements. The totals for nondepreciable soil and water and landclearing were calculated by the LITS model (see formulas for rows 23 and 28, respectively). The depreciable amount for the drainage tile was also calculated by the model (row 33) in conjunction with the calculation of the depreciable amount for buildings. The depreciable amount for single-purpose buildings (row 33) has been reduced to zero as a result of the possibility of deducting up to \$5,000 of depreciable investments in the first year. Therefore, the remaining depreciable amount from the \$1,000-investment in drainage tile and the \$4,500-investment in single-purpose buildings is \$475 or $0.95(\$5,500 - \$5,000)$. The \$475 amount also appears as the total amount of depreciable investment (row 36 of formulas).

In section 3, the finance period has been entered into the spreadsheet essentially as a constant. However, a different finance period could be considered by changing the values appearing in row 39 of the model. The rest of the values shown in section 3 are calculated by the spreadsheet. The amount of the original purchase financed in year 0 is brought down and the total of all improvements in year 1 are added to determine the long-term balance in year 1. The long-term payment is computed for use in determining the next year's balance. The interest payment is computed for use in calculating deductions for tax purposes. When the property is sold, the long-term payment is the total long-term balance plus interest (see long-term payment in year 5).

Section 4 contains totally exogenous data upon which the rest of the tax calculations in the model depend. In essence, the spreadsheet is a partial equilibrium model allowing the analysis of the tax effects of alternative land improvements--or alternative tax treatment of land improvements--while holding the rest of the farm financial situation constant.

Section 5 contains the tax calculations and incorporates numbers generated in sections 6 and 7 concerning long-term capital gains and recapture of deductions, depreciation, and investment credit. Individual rows in the section are generally self-explanatory. Most are keyed to either the Schedule F or Form 1040 Federal income tax forms. Form 3468 is referenced for the investment credit. The only rows not keyed to an IRS form, page, and line number are those for 5-year ACRS and 18-year ACRS SL depreciation (see formulas for rows 55 and 56). The numbers generated in these rows are combined for row 57: Depreciation (Sch. F 1.50).

The computation of alternative minimum tax has been included in section 5 (see formula for row 68). As incorporated into the spreadsheet, it is only operative in the case of a sale. Although other types of income may be considered tax preference income subject to the alternative minimum tax, long-term capital gains are the most likely cause of this increased tax obligation in a normal farming situation. In the sample spreadsheet, there is \$4 alternative minimum tax due upon sale of the property (year 5). The liability

for alternative minimum tax is quite sensitive to the ratio between income from other sources and that from long-term capital gains. In the sample spreadsheet, farm business receipts were reduced \$10,000--from \$175,000 to \$165,000--in order to trigger the additional alternative minimum tax obligation. With an additional \$10,000 of either farm business receipts or nonfarm income, there would be no alternative minimum tax obligation in this example.

Long-term capital gains are analyzed in section 6. The first row in this section accounts for undeducted soil and water conservation investments. Although these undeducted expenses cannot be used to reduce the basis if the property is sold after expensing of the investments is begun, they can be deducted by the taxpayer if he or she begins farming again. The second row keeps track of the basis of the property, adding any purchase after year 0 to the initial holding as well as adding landclearing and depreciable improvements while deducting allowed expensing of landclearing and depreciation. The sale row contains the amount of a total sale supplied by the model user. In the sample spreadsheet, the value used was the the original cost plus the value of the land improvements plus interest at 5 percent. The net present value column in this row shows a value that is equal to the beginning cost of the property purchased (\$256,000) plus the improvements made in year 1 (\$28,000).

As for the sale value, the rest of the rows in section 6 contain numerical data only in the year in which the property was sold (and in the last two summary columns). These data items should be clear from the row titles and from the earlier discussion of the formulas. Of the \$101,966 long-term capital gain indicated, more than \$23,000 is from land improvements expensed in year 1 but assumed to add value to the property at least equal to their cost.

The possible recapture of deductions, depreciation, and investment credit is indicated in section 7. In year 1, conservation expenses (\$17,500) and landclearing expense (\$507) from section 5 total \$18,007 as indicated in the first row of section 7. It was assumed in this example that the property had been owned 4 years before the land improvements were made (years held). Therefore, by year 5 in the spreadsheet, the property had been owned 9 years and the recapture portion was reduced to 20 percent or \$3,601. Similarly, investment credit recapture had decreased to \$10 and the ACRS depreciation recapture totalled \$5,499. In total, then, upon sale of the property in the 5th year, there are deduction, depreciation, and investment credit recaptures totalling \$9,110. In addition, \$4,498 of the improvements are included in the basis of the property. The remainder--\$14,392--comprises the net deduction from income subject to Federal income tax during the 5-year period.

Finally, section 8 contains a measure of taxpayer well-being called disposable income. As described in the discussion of the spreadsheet formulas, disposable income is basically net farm and nonfarm income less taxes and payment on long-term debt. In the year the property is sold, the sale price is added and the difference between the original purchase amount and the amount financed is deducted to remove the taxpayer's original equity from the measure. Of course, any remaining balance on long-term debt is automatically assumed to be paid off and deducted as the payment on long-term debt in the year of sale.

REFERENCES

1. Commerce Clearing House, Inc. 1985 U.S. Master Tax Guide For Returns of 1984 Income. 68th Ed. Chicago, 1984.
2. Davenport, C., M. D. Boehlje, and D. B. H. Martin. The Effects of Tax Policy on American Agriculture, AER-480. U.S. Dept. Agr., Econ. Res. Serv., 1982.
3. Huszar, P. C. and J. E. Young. "Why the Great Colorado Plow Out?" Journal of Soil and Water Conservation, Vol. 39, No. 4, pp. 232-235, July-Aug. 1984.
4. Internal Revenue Service, "Farmer's Tax Guide," Pub. 225, U.S. Dept. Treasury, Oct. 1984.
5. Lotus Development Corp. "1-2-3 Reference Manual," Release 2, Cambridge, MA, 1985.
6. Office of Technology Assessment. Wetlands: Their Use and Regulation. OTA-O-206. U.S. Congress, Mar. 1984.
7. Watts, M. J., L. D. Bender, and J. B. Johnson. Economic Incentives for Converting Rangeland to Cropland. Bull. 1302, Coop. Ext. Serv., Montana State Univ., Nov. 1983.

Appendix table 1--Land Improvement Tax Simulator formulas for the Nth year

Land Improvement Tax Simulation (LITS) Version 2 6/10/86 for individual returns - 1984 tax regulations

	Row	Year N
Section 1: Land purchase		
Purchase amount	5	0
Amount financed	6	0
Section 2: Improvements		
Nondepreciable: soil and water		
Leveling and grading	10	0
Soil conditioning	11	0
Terracing	12	0
Restoration of fertility	13	0
Diversión channels	14	0
Drainage ditches	15	0
Irrigation ditches	16	0
Earthen dams	17	0
Watercourses and outlets	18	0
Ponds	19	0
Eradication of brush	20	0
Windbreaks	21	0
SCWD assessments	22	0
Total	23	@SUM(N10..N22)
Nondepreciable: landclearing		
Removal of trees and rocks	25	0
Earthmoving	26	0
Drainage and filling	27	0
Total	28	@SUM(N25..N27)
Depreciable:		
Drainage tile (Sec. 1245) 1/	30	0
Machinery and equipment (Sec. 1245)	31	0
Single-purpose buildings (Sec. 1245)	32	0
Depreciable amount	33	0.95*@MAX(0,N30+N31+N32-5000)
Multipurpose buildings (Sec. 1250)	34	0
Depreciable amount	35	+N34
Total	36	@SUM(N33+N35)
Section 3: Financing improvements		
Finance period	39	9
Long-term balance	40	@MAX(0,+M40-M41+M40*\$AA\$25+N6+N23+N28+N30+N31+N32+N34)
Long-term payment	41	@IF(N74>0,N40*(1+\$AA\$25),@PMT(N40,\$AA\$25,N39))
Interest payments	42	+N40*\$AA\$25
Section 4: Other tax items		
Farm business receipts	45	0
Farm business expenses	46	0
Nonfarm income	47	0
Adjustments to income	48	0
Itemized deductions & exemptions	49	0
Section 5: Tax calculations		
Gross farm income (Sch. F 1.31)	52	+N45
Consv. expense (Sch. F 1.49)	53	@MIN(@SUM(\$C23..M23)-@SUM(\$C53..M53)+N23,0.25*N52)

Land Improvement Tax Simulation (LITS) Version 2 6/10/86 for individual returns - 1984 tax regulations

Section	Row	Exogenous data required for base year	Exogenous data required for subsequent year and/or years
Section 1: Land purchase			
Purchase amount	5	Initial capital value of the real estate	Amount of land purchase and/or improvements to be capitalized, vs. deducted in section 2
Amount financed	6	Amount of the capital value financed at the beginning of the analysis	(Total amount of the purchase/improvements above is assumed to be financed)
Section 2: Improvements			
Nondepreciable: soil and water	10		Amount of the specified improvement to be expensed in the tax analysis
Leveling and grading	11		Amount of the specified improvement to be expensed in the tax analysis
Soil conditioning	12		Amount of the specified improvement to be expensed in the tax analysis
Terracing	13		Amount of the specified improvement to be expensed in the tax analysis
Restoration of fertility	14		Amount of the specified improvement to be expensed in the tax analysis
Diversions channels	15		Amount of the specified improvement to be expensed in the tax analysis
Drainage ditches	16		Amount of the specified improvement to be expensed in the tax analysis
Irrigation ditches	17		Amount of the specified improvement to be expensed in the tax analysis
Earthen dams	18		Amount of the specified improvement to be expensed in the tax analysis
Watercourses and outlets	19		Amount of the specified improvement to be expensed in the tax analysis
Ponds	20		Amount of the specified improvement to be expensed in the tax analysis
Eradication of brush	21		Amount of the specified improvement to be expensed in the tax analysis
Windbreaks	22		Amount of the specified improvement to be expensed in the tax analysis
SOD assessments			
Nondepreciable: Landclearing			
Removal of trees and rocks	25		Amount of the specified improvement to be expensed in the tax analysis
Earthmoving	26		Amount of the specified improvement to be expensed in the tax analysis
Drainage and filling	27		Amount of the specified improvement to be expensed in the tax analysis
Depreciable:			
Drainage tile (Sec. 1245) 1/	30		Amount of the depreciable investment to be included in the tax analysis
Machinery & equipment (Sec. 1245)	31		Amount of the depreciable investment to be included in the tax analysis
Single-purpose bldgs. (Sec. 1245)	32		Amount of the depreciable investment to be included in the tax analysis
Multipurpose bldgs. (Sec. 1250)	34		Amount of the depreciable investment to be included in the tax analysis
Section 4: Other tax items			
Farm business receipts	45		Annual farm business receipts produced for the case being analyzed
Farm business expenses	46		Annual business expenses for the case being analyzed
Nonfarm income	47		Annual nonfarm income included in the tax liability of the case being analyzed
Adjustments to income	48		Deductions from income from p. 1, IRS Form 1040 to compute Adjusted Gross Income
Itemized deductions & exemptions	49		Itemized deductions & personal exemptions deductible in calculating taxable income
Section 6: Capital gains (long-term)			
Sale	74		Amount of the sale (land plus improvements) in the year sold
Years held	85	Years the property has been owned at the beginning of the analysis	(Computed by the model after the base year)

1/ Numbers in parentheses refer to Internal Revenue Code sections (Sec.).